JOB SHEET

Irrigation Water Management, Water Meters

Oklahoma Conservation Practice Job Sheet **449**

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USDA Natural Resources Conservation Service (NRCS)

Landowner_____



Sound water management begins with knowing flowrates and volumes.

WHY MEASURE?

Accurately measuring irrigation flowrates is integral to proper irrigation water management. The flowrate not only defines hardware features such as pumping plant efficiency and pipeline sizes, but also establishes such management criteria as timing of irrigation sets, irrigation frequency, and return intervals. When incorporated into an overall irrigation water management plan, water losses are kept to a minimum.

WHEN TO MEASURE?

Ideally, flowrate should be checked during each irrigation. This is only feasible with a permanently installed flowmeter. Pump discharge can fluctuate due to a variety of circumstances. Changes in aquifer water levels during an irrigation and throughout the irrigation season can have a severe impact on flowrates. Changes in motor speed for internal combustion engines used to drive pumping plants will also change flows. Fluctuating flowrates may also be an indication of problems with pumping plant or drive motor.

As a minimum, flowrates should be checked at the beginning of the irrigation season and at least once during the season. Checks should be made under full operating conditions where practical.

TYPES OF FLOWMETERS

There are many types of commercial flowmeters available for water measurement. The specific type chosen will depend on the individuals needs and goals as well as the type of delivery system on which the flowmeter will be used. Where pipelines are used as the delivery system, the most common type of flowmeter is a propeller type that is permanently installed. Portable propeller type units are also available for periodic flowrate checks. However, this requires that the delivery system be disassembled for the installation of the meter. A non-intrusive ultra-sonic type flowmeter is now available for making instantaneous flow measurements under operating conditions.

PERMANENT INSTALLATIONS

This job sheet is not intended to restrict users to any particular style, configuration, or manufacturer; however, meters of all types shall meet the following requirements:

1. Accuracy – The water meter shall be calibrated at the factory and shall be warranted to register within ± 2 percent of the actual volume of water passing the meter. This requirement shall be met throughout the normal operating range of the meter.

2. Meter Body – The meter body shall be constructed from metal of suitable strength and rigidity to maintain its shape and integrity under all normal field conditions. Where metals are used that are subject to rust or corrosion (cast iron, steel, etc.), the entire meter body surface shall be protected with an impervious coating applied by the manufacturer. The meter size, serial number, and direction of flow shall be clearly stamped on the body of the meter. The inside pipe diameter for which the meter has been calibrated shall be clearly shown on the meter to the nearest one-thousandth (0.001) of an inch.

3. Register and Indicator – The meter shall be equipped with a direct reading odometer type totalizing register and rate of flow indicator (or test dial) sealed in a water tight (weather-proof) housing. The register shall be equipped so that it may be secured with a wire, lead seal, or other sealing device

to prevent unauthorized tampering. The totalizing register shall provide direct readings in acre-feet, acre-inches, or gallons. The rate of flow indicator shall be either a direct display of rate of flow in gallons per minute or a center sweep hand indicating acre-feet, acre-inches, or gallons per revolution. The dial face shall clearly indicate the units measured. The register assembly shall be designed to be interchangeable in the field without altering the accuracy of the meter.

4. Installation – The meter shall be installed according to the manufacturer's recommendations and in such a manner to insure full pipe flow at all times while water is being pumped. Full pipe flow may be obtained by using butterfly valves or by raising the pipe beyond the meter to a point above the level of the water. The meter shall be placed in a section of line free from obstructions such as valves or elbow for a length of at least 5 pipe diameters upstream and 2 pipe diameters downstream. If these conditions cannot be obtained, straightening vanes shall be installed upstream of the meter according to the manufacturer's recommendations.

Propeller Meters

In addition to the basic requirements for all water meters, propeller type meters shall meet the following criteria:

The propeller shall be constructed from corrosion resistant material (plastic, stainless steel, etc.) of a rigid but resilient nature. The diameter of the propeller shall be no less than one-half the diameter of the pipe in which the meter is installed. The propeller shall be mounted on a non-corrosive shaft and with a bearing assembly designed to withstand all shocks and thrusts which can reasonably be expected in the proposed use. The propeller and bearing assembly shall be designed to prevent sand and entrained debris from adversely affecting the operation and accuracy of the meter.

ULTRA-SONIC FLOWMETERS

This type of meter uses sound waves to determine the velocity of the flowing liquid. From the velocity, the flowrate is determined based on the pipeline characteristics (size, material, and wall thickness). Ultra-sonic flowmeters are ideal for making instantaneous checks of wells under operating conditions and many systems can be evaluated in a relatively short period of time. However, they are limited when it comes to long duration use or total volume measurements. The ultra-sonic type flowmeter is also a great tool for checking the accuracy of permanently installed meters. Checks of permanently installed meters are recommended at least annually.

WHAT TO DO WITH FLOW MEASUREMENTS

Basic irrigation water management begins with knowing for four key items: (1) area to be irrigated, (2) depth of water to apply, (3) time of system operation, and (4) flowrate. The relationship is:

$$QT = DA$$

where:

Q = flowrate in cubic feet per second
T = time in hours
D = depth in inches
A = area in acres

Accurately knowing the flowrate (Q), the time (T) of an irrigation set can be adjusted to apply the appropriate depth (D) over the desired area (A). Similarly, the area or depth could be varied to match a particular irrigation time-set for a particular flowrate. Of course adjustments in depths are needed due to inherent inefficiencies of the delivery or application system.

Accurate flowrates are also valuable in the design of the most efficient irrigation system. Properly sized delivery components and properly designed application systems will not only save water but also energy and money.

FOR ADDTIONAL ASSISTANCE

Contact your local NRCS or conservation district office for additional information relating to flow measurement, detailed irrigation designs, and irrigation scheduling.